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Thermal Stresses in Ferroelectric Thin Films and Their Role on the Dielectric, Pyroelectric, and Electrocaloric Properties JIALAN ZHANG, S. PAMIR ALPAY, University of Connnecticut — In-plane strains develop in thin films due to thermal stresses that arise from differences between the thermal expansion coefficients of the film and the substrate upon cooling from a growth temperature (T_G) to room temperature (RT). In ferroelectric (FE) films, there is a coupling between strain and polarization through electrostriction. Therefore, thermal strains may have profound effects on the dielectric, pyroelectric, and electrocaloric (EC) responses of FE films. We provide here a quantitative thermodynamic model to investigate the role of in-plane thermal strains on these properties. We show that there is a substantial degradation in the dielectric response and tunability of $SrTiO_3$ films on IC-friendly substrates such as Si and *c*-sapphire due to tensile thermal in-plane strains. Our analysis on (001)-textured polycrystalline $Ba_xSr_{1-x}O_3$ (BST) films with different compositions indicates that for BST 60/40 and BST 70/30 films, the pyroelectric response does not display a significant dependence onT_G if the FE is in a paraelectric state. Furthermore, we show that for $BaTiO_3$ films on Si, the thermal stresses are sufficient to shift the zero-field Curie temperature to RT, resulting in a strong enhancement of the EC properties as compared to the bulk material.

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